A6

$$X(L) = \frac{\left(\sum_{n=0}^{N-1} (d(n)(d(n-L))\right)^2}{\left(\sum_{n=o}^{N-1} d(n)\right)^2 \left(\sum_{n=0}^{N-1} d(n-L)\right)^2}$$

Page 70, line 25, delete "of" and insert "if".

line 26, after "1" delete - -) - -; and after "0.5" insert ") ".

line 30, delete "encoder" second occurrence and insert - - decoder - -.

Page 71, line 23, delete "complesxity" and insert -- complexity - -.

Page 73, line 2, delete "contained within" and insert - - obtained from -- .

Page 74, line 15, delete "systems" and insert - - system - -.

In the Claims

Please cancel claims 2, 3, 5, 10, 33, and 34.

Please amend the following claims as follows:

A7

1. (Amended) A method of conditioning a composite signal, the composite signal being formed by introducing <u>at least a portion of</u> a first signal into a second signal, comprising:

estimating a characteristic of at least one of said first and <u>composite</u> [second] signals; and

selectively conditioning the composite signal, the selection <u>of</u> [as to] whether to condition the composite signal being based on the estimated characteristic.

A8 Cont

6. (Amended) The method of claim 4 wherein the characteristic estimation comprises estimating a return loss between the composite signal and the first signal,

estimating a return loss enhancement, the return loss enhancement comprising a reduction in power of the composite signal due to the signal conditioning in the absence of the second signal, and wherein the conditioning of the composite signal further comprises adjusting the filter adaptation as a function of at least one of the estimated return loss and the estimated return loss enhancement.

7. (Amended) The method of claim 4 wherein the characteristic estimation, comprises:

estimating a first power level of the first signal;

estimating a second power level of the composite signal;

estimating a return loss between the composite signal and the first signal by dividing the first power level by the second power level;

estimating a third power level of the recovered second signal; and

estimating a return loss enhancement by dividing the second [third] power level by the third [second] power level;

wherein the conditioning of the composite signal further comprises adjusting the filter adaptation as a function of at least one of the return loss and return loss enhancement.

8. (Amended) The method of claim 4 further comprising processing [attenuating] the recovered second signal when information is detected in the first signal but not in the second signal.

9. (Amended) A method of cancelling a far end echo from a near end signal, comprising:

estimating a characteristic of at least one of a far end signal and the near end signal; and

selectively cancelling the echo from the near end signal, the selection of [as to] whether to cancel the echo from the near end signal being based on the estimated characteristic.

12. (Amended) The method of claim 9 wherein the characteristic estimation comprises estimating a power level of the far end signal, estimating an echo return loss

between the far end signal and the near end signal, and estimating a power level of the near end signal, wherein the selection of [as to] whether to cancel the echo from the near end signal is based on the estimated power levels and the estimated echo return loss.

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14. (Amended) The method of claim 9 [13] wherein the characteristic estimation comprises estimating a power level of the far end signal, estimating an echo return loss between the far end signal and the near end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the echo is canceled from the near end signal when the power level of the far end signal minus the echo return loss is greater than both a threshold of hearing and the power level for the noise minus about 10 dB.

15. (Amended) The method of claim 13 wherein the characteristic estimation comprises estimating an echo return loss between the far end signal and the near end signal, and estimating an echo return loss enhancement between the near end signal and the near end signal without the echo, and wherein [the echo is canceled by selectively adjusting the] filter adaptation is [as] a function of at least one of the echo return loss and echo return loss enhancement.

16. (Amended) The method of claim 15 wherein [the selective adjustment of] the filter adaptation comprises using an adaptation step size of one-fourth when the echo return loss enhancement is in the range of 0-9 dBm.

17. (Amended) The method of claim 15 wherein [the selective adjustment of] the filter adaptation comprises using an adaptation step size of 1/32 when a combination of the estimated echo return loss and the echo return loss enhancement is greater than 33-36 dB.

18. (Amended) The method of claim 15 wherein [the selective adjustment of] the filter adaptation comprises using an adaptation step size of 1/16 when a combination of the estimated echo return loss and the echo return loss enhancement is in the range of 23-33 dB.

19. (Amended) The method of claim 13 further comprising detecting information in the near end signal, wherein [the selective adjustment of] the filter adaptation comprises limiting [disabling] the filter adaptation when the information is detected and the filter adaptation is converged.

A10 Cont.

20. (Amended) The method of claim 13 [19] wherein the filter adaptation is limited [converged] when the filter adaptation has been active for a period longer than one second from an off hook transition of a telephony device connected between the far end signal and the near end signal.

21. (Amended) The method of claim 13 [19] wherein the filter adaptation is limited [converged] when the filter adaptation has been active for a period longer than one second after filter adaptation initialization.

22. (Amended) The method of claim 19 wherein [the selective adjustment of] the filter adaptation comprises using an adaptation step size of 1/32 when the information is detected and the filter adaptation is not converged.

23. (Amended) The method of claim 13 wherein the characteristic estimation further comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein [the selective adjustment of] the filter adaptation comprises using an adaptation step size of 1/4 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 24 dB.

24. (Amended) The method of claim 13 wherein the characteristic estimation comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein [the selective adjustment of] the filter adaptation comprises using an adaptation step size of 1/8 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 18 dB.

A10 Cncld

25. (Amended) The method of claim 13 wherein the characteristic estimation further comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein [the selective adjustment of] the filter adaptation comprises using an adaptation step size of 1/16 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 9 dB.

26. (Amended) The method of claim 9 further comprising detecting information in the far end signal, detecting information in the near end signal, and [non linear] processing the near end signal when information is detected in the far end signal and not in the near end signal.

A11

29. (Amended) The method of claim 28 wherein the first decision variable is set when the estimated power level of the far end signal is at least 6 dB greater than the estimated power level of the noise on the far end signal, and the estimated power level of the far end signal minus <u>an</u> [the] estimated echo return loss between the far end signal and the near end signal is at least 6 dB greater larger than the estimated power level of the near end signal.

A12

32. (Amended) A signal conditioner for conditioning a composite signal, the composite signal being formed by introducing <u>at least a portion of</u> a first signal into a second signal, comprising:

a canceller to <u>recover the second</u> [cancel the first] signal from the composite signal; and

a bypass to selectively enable the canceller.

A13

35. (Amended) The signal conditioner of claim 32 further comprising a power estimator to estimate a maximum power level and an average power level of the first signal, and adaptation logic to estimate a return loss between the first signal and the composite signal, wherein the bypass enables the canceller as a function of <u>at least one of the estimated maximum power level, the estimated average power level,</u> [the estimated power levels and] the estimated return loss.

A14

39. (Amended) The signal conditioner of claim 32 wherein the [echo] canceller further comprises an adaptive filter to filter the first signal, and a combined operator to subtract the filtered first signal from the composite signal to recover the second signal.

40. (Amended) The signal conditioner of claim 39 further comprising a [non linear] processor, and adaptation logic which invokes the [non linear] processor to suppress the recovered second signal when information is detected in the first signal but not in the composite signal.

A15

48. (Amended) The signal conditioner of claim 45 [wherein the filter adaptation logic estimates a first signal power level, and] wherein the filter adapter causes the adaptive filter to have a filter adaptation step size of 1/4 when the estimated <u>average</u> power level of the first signal is 24 dB greater than the estimated power level of the noise of the recovered second signal.

A16

52. (Amended) The signal conditioner of claim 44 wherein the adaptation logic <u>limits</u> [disables] the filter adapter when the adaptation logic detects information in the composite signal and the adaptive filter is converged.

A17

54. (Amended) The signal conditioner of claim <u>44</u> [52] wherein the adaptation logic <u>limits</u> [determines that] the <u>adaptation of the</u> adaptive filter [is converged] when the [adaptation of the] adaptive filter has been active for a period longer than one second after an off hook transition of a telephony device coupled between the first signal and the composite signal.

55. (Amended) The signal conditioner of claim <u>44</u> [52] wherein the adaptation logic <u>limits</u> [determines that] the <u>adaptation of the</u> adaptive filter [is converged] when the [adaptation of the] adaptive filter has been active for a period longer than one second after the adaptive filter is initialized.

[Please add the following new claims:]

A18 Cont.

59. The method of claim 1 wherein the characteristic estimation comprises estimating a power level of the first signal, and estimating an echo return loss between the first signal and the composite signal, and wherein the composite signal is conditioned echo if the estimated power level of the first signal minus the echo return loss is greater than a threshold.

60. The method of claim 4 further comprising selectively limiting filter adaptation, the selection of whether to limit the filter adaptation being based on the estimated characteristic.

61. The method of claim 60 wherein the filter adaptation is limited by disabling the filter adaptation.

62. The method of claim 8 wherein the recovered second signal is processed by attenuation.

63. The method of claim 8 wherein the processing of the recovered second signal is non-linear.

64. The method of claim 13 further comprising selectively limiting filter adaptation, the selection of whether to limit the filter adaptation being based on the estimated characteristic.

65. The method of claim 62 wherein the filter adaptation is limited by disabling the filter adaptation.

66. The method of claim 19 wherein the limiting of the filter adaption comprises disabling the filter adaption.

67. The method of claim 26 wherein the near end is processed by attenuation. - -

68. The method of claim 26 wherein the processing of the near end signal is non-linear.

69. The signal conditioner of claim 40 wherein the processor comprises a non-linear processor.

A18 Cont

70. The signal conditioner of claim 43 wherein the filter adapter limits the adaptation of the adaptive filter when the bypass does not enable the canceller.

71. The signal conditioner of claim 69 wherein the filter adaptation is limited by disabling the adaptation of the adaptive filter.

72. Computer-readable media embodying a program of instructions executable by a computer to perform a method of conditioning a composite signal, the composite signal being formed by introducing at least a portion of a first signal into a second signal, the method comprising:

estimating a characteristic of at least one of said first and composite signals; and

selectively conditioning the composite signal, the selection of whether to condition the composite signal being based on the estimated characteristic.

73. The computer-readable media of claim 72 wherein the characteristic estimation comprises estimating a power level of the first signal, and estimating an echo return loss between the first signal and the composite signal, and wherein the composite signal is conditioned echo if the estimated power level of the first signal minus the echo return loss is greater than a threshold.

74. The computer-readable media of claim 72 wherein the conditioning of the composite signal comprises adaptively filtering the first signal, and recovering the second signal by subtracting the filtered first signal from the composite signal.

75. The computer-readable media of claim 74 wherein the method further comprises selectively limiting filter adaptation, the selection of whether to limit the filter adaptation being based on the estimated characteristic.

76. The computer-readable media of claim 75 wherein the filter adaptation is limited by disabling the filter adaptation.

A18 Cont

77. The computer-readable media of claim 74 wherein the characteristic estimation comprises estimating a return loss between the composite signal and the first signal, estimating a return loss enhancement, the return loss enhancement comprising a reduction in power of the composite signal due to the signal conditioning in the absence of the second signal, and wherein the conditioning of the composite signal further comprises adjusting the filter adaptation as a function of at least one of the estimated return loss and the estimated return loss enhancement.

78. The computer-readable media of claim 74 wherein the characteristic estimation, comprises:

estimating a first power level of the first signal;

estimating a second power level of the composite signal;

estimating a return loss between the composite signal and the first signal by dividing the first power level by the second power level;

estimating a third power level of the recovered second signal; and

estimating a return loss enhancement by dividing the second power level by the third power level;

wherein the conditioning of the composite signal further comprises adjusting the filter adaptation as a function of at least one of the return loss and return loss enhancement.

79. The computer-readable media of claim 74 wherein the method further comprises processing the recovered second signal when information is detected in the first signal but not in the second signal.

80. The computer-readable media of claim 79 wherein the recovered second signal is processed by attenuation.

81. The computer-readable media of claim 79 wherein the processing of the recovered second signal is non-linear.

A18 Cont

82. Computer-readable media embodying a program of instructions executable by a computer to perform a method of cancelling a far end echo from a near end signal, the method comprising:

estimating a characteristic of at least one of a far end signal and the near end signal; and

selectively cancelling the echo from the near end signal, the selection of whether to cancel the echo from the near end signal being based on the estimated characteristic.

83. The computer-readable media of claim 82 wherein the characteristic estimation comprises estimating a power level of the far end signal, and estimating an echo return loss between the far end signal and the near end signal, and wherein the echo is cancelled from the near end signal if the estimated power level of the far end signal minus the echo return loss is greater than a threshold.

84. The computer-readable media of claim 82 wherein the characteristic estimation comprises estimating a power level of the far end signal, estimating an echo return loss between the far end signal and the near end signal, and estimating a power level of the near end signal, wherein the selection of whether to cancel the echo from the near end signal is based on the estimated power levels and the estimated echo return loss.

85. The computer-readable media of claim 82 wherein the echo cancellation comprises adaptively filtering the far end signal and subtracting the filtered far end signal from the near end signal.

86. The computer-readable media of claim 85 wherein the method further comprises selectively limiting filter adaptation, the selection of whether to limit the filter adaptation being based on the estimated characteristic.

87. The computer-readable media of claim 86 wherein the filter adaptation is limited by disabling the filter adaptation.

88. The computer-readable media of claim 82 wherein the characteristic estimation comprises estimating a power level of the far end signal, estimating an echo return loss between the far end signal and the near end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the echo is canceled from the near end signal when the power level of the far end signal minus the echo return loss is greater than both a threshold of hearing and the power level for the noise minus about 10 dB.

89. The computer-readable media of claim 85 wherein the characteristic estimation comprises estimating an echo return loss between the far end signal and the near end signal, and estimating an echo return loss enhancement between the near end signal and the near end signal without the echo, and wherein filter adaptation is a function of at least one of the echo return loss and echo return loss enhancement.

90. The computer-readable media of claim 89 wherein the filter adaptation comprises using an adaptation step size of one-fourth when the echo return loss enhancement is in the range of 0-9 dBm.

91. The computer-readable media of claim 89 wherein the filter adaptation comprises using an adaptation step size of 1/32 when a combination of the estimated echo return loss and the echo return loss enhancement is greater than 33-36 dB.

92. The computer-readable media of claim 89 wherein the filter adaptation comprises using an adaptation step size of 1/16 when a combination of the estimated echo return loss and the echo return loss enhancement is in the range of 23-33 dB.

93. The computer-readable media of claim 85 wherein the method further comprises detecting information in the near end signal, wherein the filter adaptation comprises limiting the filter adaptation when the information is detected and the filter adaptation is converged.

94. The computer-readable media of claim 93 wherein the limiting of the filter adaption comprises disabling the filter adaption.

A18 A Cont.

95. The computer-readable media of claim 85 wherein the filter adaptation is limited when the filter adaptation has been active for a period longer than one second from an off hook transition of a telephony device connected between the far end signal and the near end signal.

96. The computer-readable media of claim 85 wherein the filter adaptation is limited when the filter adaptation has been active for a period longer than one second after filter adaptation initialization.

97. The computer-readable media of claim 93 wherein the filter adaptation comprises using an adaptation step size of 1/32 when the information is detected and the filter adaptation is not converged.

98. The computer-readable media of claim 85 wherein the characteristic estimation further comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the filter adaptation comprises using an adaptation step size of 1/4 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 24 dB.

99. The computer-readable media of claim 85 wherein the characteristic estimation comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the filter adaptation comprises using an

adaptation step size of 1/8 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 18 dB.

100. The computer-readable media of claim 85 wherein the characteristic estimation further comprises estimating a power level of the far end signal, and estimating a power level for noise on the near end signal without the echo, and wherein the filter adaptation comprises using an adaptation step size of 1/16 when the estimated power level of the far end signal exceeds the estimated power level of the noise by at least 9 dB.

A18 Cont

101. The computer-readable media of claim 82 wherein the method further comprises detecting information in the far end signal, detecting information in the near end signal, and processing the near end signal when information is detected in the far end signal and not in the near end signal.

102. The computer-readable media of claim 101 wherein the near end is processed by attenuation.

103. The computer-readable media of claim 101 wherein the processing of the near end signal is non-linear.

104. The computer-readable media of claim 82 wherein the characteristic estimation comprises estimating a power level of the far end signal, estimating a power level of the near end signal, estimating a power level of a near end signal without the echo, estimating a power level of noise on the far end signal, and selectively non linear processing the near end signal, the selection as to whether to non linear process the near end signal being based on the estimated power levels.

105. The computer-readable media of claim 104 wherein the method further comprises setting a first decision variable as a function of the estimated power level of the far end signal, setting a second decision variable as a function of the power level of the near end signal without the echo, setting a third decision variable as a function of the estimated power

level of the far end signal and the near end signal without the echo, wherein the is near end signal is non linear processed when at least of the two decision variables meet a respective criteria.

106. The computer-readable media of claim 105 wherein the first decision variable is set when the estimated power level of the far end signal is at least 6 dB greater than the estimated power level of the noise on the far end signal, and the estimated power level of the far end signal minus an estimated echo return loss between the far end signal and the near end signal is at least 6 dB greater larger than the estimated power level of the near end signal.

A18 Cont.

107. The computer-readable media of claim 104 wherein the second decision variable is set when the estimated power level of the near end signal without the echo is at least 9 dB less than the estimated power level of the near end signal.

108. The computer-readable media of claim 104 wherein the third decision variable is set when the estimated power level of the far end signal minus the estimated power level of the near end signal without the echo is greater than a threshold power level.

~~109~~. A signal conditioner for conditioning a composite signal, the composite signal being formed by introducing at least a portion of a first signal into a second signal, comprising:

canceller means for recovering the second signal from the composite signal; and

bypass means for selectively enabling the cancelling means.

110. The signal conditioner of claim 109 further comprising means for estimating a maximum power level and an average power level of the first signal, and means for estimating a return loss between the first signal and the composite signal, wherein the bypass means enables the canceller means as a function of at least one of the estimated maximum power level, the estimated average power level, the estimated return loss.

111. The signal conditioner of claim 110 wherein the bypass means enables the canceller means when the estimated maximum power level of the first signal minus the estimated return loss is greater than a threshold.

112. The signal conditioner of claim 110 further comprising second means for estimating an average power level of the composite signal, wherein the means for estimating a return loss divides the estimated average power level of the first signal by the estimated average power level of the composite signal.

A18 Cont

113. The signal conditioner of claim 112 wherein the bypass means enables the canceller means when the estimated maximum power level of the first signal minus the estimated return loss is at least 8 dB greater than the estimated power level of the composite signal.

114. The signal conditioner of claim 109 wherein the canceller means further comprises adaptive filter means for filtering the first signal, and means for subtracting the filtered first signal from the composite signal to recover the second signal.

115. The signal conditioner of claim 114 further comprising means for suppressing the recovered second signal when information is detected in the first signal but not in the composite signal.

116. The signal conditioner of claim 115 wherein the information includes voice.

117 The signal conditioner of claim 115 wherein the means for suppressing the recovered second signal is non linear.

118. The signal conditioner of claim 114 further comprising means for estimating a maximum power level of the first signal, means for estimating a noise power level for the recovered second signal, and means for estimating a return loss between the first signal and the composite signal, wherein the bypass means enables the canceller means when the

estimated maximum power level of the first signal minus the estimated return loss is greater than both a threshold of hearing and the estimated power level of the noise of the recovered second signal minus 8 dB.

119. The signal conditioner of claim 114 further comprising adjusting means for adjusting the adaptation of the adaptive filter means.

120. The signal conditioner of claim 119 wherein the adjusting means limits the adaptation of the adaptive filter means when the bypass means does not enable the canceller means.

121. The signal conditioner of claim 120 wherein the adjusting means limits the adaptive filter means by disabling the adaptation of the filter means.

122. The signal conditioner of claim 119 further comprising return loss estimation means for estimating a return loss between the first signal and the composite signal and a return loss enhancement between the composite signal and the recovered second signal, the adjusting means adjusting the adaptation of the adaptive filter means as a function of the estimated return loss and the estimated return loss enhancement.

123. The signal conditioner of claim 122 further comprising means for estimating a maximum power level and an average power level of the first signal, means for estimating average power level of the composite signal, and means for estimating an average power level and a noise power level for the recovered second signal, wherein the return loss estimation means estimates the return loss and the return loss enhancement as a function of the estimated power levels.

124. The signal conditioner of claim 123 wherein the return loss estimation means estimates the return loss by dividing the average power level of the first signal by the average power level of the composite signal.

125. The signal conditioner of claim 123 wherein the return loss means estimates the return loss enhancement by dividing the average power of the composite signal by the average power of the recovered second signal.

126. The signal conditioner of claim 123 wherein the adjusting means causes the adaptive filter means to have a filter adaptation step size of 1/4 when the estimated average power level of the first signal is 24 dB greater than the estimated power level of the noise of the recovered second signal.

127. The signal conditioner of claim 123 wherein the adjusting means causes the adaptive filter means to have a filter adaptation step size of about 1/8 when the estimated average power level of the first signal is18 dB greater than the estimated power level of the noise on the recovered second signal.

128. The signal conditioner of claim 123 wherein the adjusting means causes the adaptive filter means to have a filter adaptation step size of 1/16 when the estimated average power level of the first signal is 9 dB greater than the estimated power level of the noise on the recovered second signal.

129. The signal conditioner of claim 122 wherein the adjusting means causes the adaptive filter means to have an adaptation step size of 1/16 when a combination of the estimated return loss and the estimated return loss enhancement is in the range of about 23-33 dB.

130. The signal conditioner of claim 122 wherein the adjusting means limits the adaptation of the adaptive filter means when information is detected in the composite signal and the adaptive filter means is converged.

131. The signal conditioner of claim 130 wherein the information includes voice.

132. The signal conditioner of claim 122 wherein the adjusting means limits the adaptation of the adaptive filter means when the adaptive filter means has been active for a period longer than one second after an off hook transition of a telephony device coupled between the first signal and the composite signal.

A/18 Cont'd

133. The signal conditioner of claim 122 wherein the adjusting means limits the adaptation of the adaptive filter means when the adaptive filter means has been active for a period longer than one second after the adaptive filter means is initialized.

134. The signal conditioner of claim 122 wherein the adjusting means causes the adaptive filter means to have an adaptation step size of 1/32 when information is detected in the composite signal and the adaptive filter means is not converged.

135. The signal conditioner of claim 122 wherein the adjusting means causes the adaptive filter means to have an adaptation step size of one-fourth when the estimated return loss enhancement is in the range of 0-9 dBm.

136. The signal conditioner of claim 122 wherein the adjusting means causes the adaptive filter means to have an adaptation step of 1/32 when a combination of the estimated return loss and the estimated return loss enhancement is greater than 33 dB.